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EXAMINER

LIANG, LEONARD S

ART UNIT	PAPER NUMBER
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2853

DATE MAILED: 05/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/878,946

Applicant(s)

KUBOTA ET AL.

Examiner

Leonard S Liang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-61 is/are pending in the application.
- 4a) Of the above claim(s) 1-46 is/are withdrawn from consideration.
- 5) ☐ Claim(s) 51 and 52 is/are allowed.
- 6) ☒ Claim(s) 47-50 and 53-61 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 47-52 and 53-61, drawn to a combination of an apparatus including a communication system and a liquid container, classified in class 347, subclass 19.
- II. Claims 1-10, 11-21, 22-23, 24-29, 30-38, and 39-46, drawn to a sub-combination of solid semiconductor element, ink tank, a liquid change information acquiring method, or a discriminating method, classified in class 73, subclass 1.

The inventions are distinct, each from the other because:

Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because neither a communication system, a liquid container, nor a liquid ejection recording apparatus is required to comprise a solid semiconductor element; for example, many ink-jet printers do not comprise solid semi-conductor elements. In addition, the disclosure of a **liquid** container and a **liquid** ejection recording apparatus does not necessarily imply the presence of **ink**; it is conceivable to one of ordinary skill in the art to have a communication system, which uses a liquid other than ink. Finally, many communication systems, do not possess a liquid change information method, nor a discriminating method; for example, a telegraph. The subcombination has separate utility in that it is well known to one of ordinary skill in the art that there are a wide variety of devices and applications, which comprise a solid semiconductor, yet are not considered communication systems, do not possess a liquid container, and are not liquid ejection recording apparatuses. Furthermore, it is well known to one of ordinary skill in the art that an ink tank is used in many devices, which are not communication system. Finally, it is well know to one of ordinary skill in the art that a liquid change

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information acquiring method, and a discriminating method could be used in a wide variety of applications.

The inventions are distinct, each from the other because of the following reasons:

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Within Group II the following further species restriction requirement is made:

This application contains claims directed to the following patentably distinct species of the claimed invention:

- II-A. A detection device including solid semiconductor element: residual amount detector, as shown by Figures 1 and 2, as well as Page 2, Lines 16-17.
- II-B. A detection device including solid semiconductor element: ion concentration sensor, as shown by Figure 19, as well as Page 63, Line 10.
- II-C. A detection device including solid semiconductor element: ion selective field effect transistor, as shown by Page 64, Lines 16-17.
- II-D. A detection device including solid semiconductor element: ion concentration index, as shown by Page 67, Line 14.
- II-E. A detection device including solid semiconductor element: liquid concentration, as shown by Page 45, Line 14.
- II-F. A detection device including solid semiconductor element: liquid density, as shown by Page 45, Line 14.
- II-G. A detection device including solid semiconductor element: viscosity, as shown by Page 45, Line 21.
- II-H. A detection device including solid semiconductor element: surface tension, as shown by Page 45, Lines 21-22.

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Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, no claims are generic.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

During a telephone conversation with Michael O'Neil on 4/11/02 a provisional election was made without traverse to prosecute the invention of Group I, claims 47-61. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-46 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: I_a , V , N_a , μ_a , H , Z , μ_o , Z_a , J , ϕ , f_o , 102, 1, T_{pg} , h , I , 212, 1600, 1607, 1500, 1011, 1150, 1152, 1012-1018, 91, 96, 1550, 1521, 1522, 1526, P_o , and P . A proposed drawing correction or corrected drawings are

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required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 805, R_a, R, C, DH, 405, 406, 415, 31, 304b, 324, 527, C, R_o, V_{out}, 11-18, 31-36, 101, 150-152, 500, 550, 600, 607. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 61 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Referring to claim 61, it recites the limitation “liquid ejection head” in the disclosed liquid ejection recording apparatus. There is insufficient antecedent basis for this limitation in the claim. It will be construed that the claim should read, “The liquid ejection recording apparatus **according to claim 60**, wherein said ejection head...”

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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5. Claims 47-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maurelli (US Pat 6099101) in view of Moriyama (US Pat 5841448), and further in view of Puukangas (US Pat 5735167).

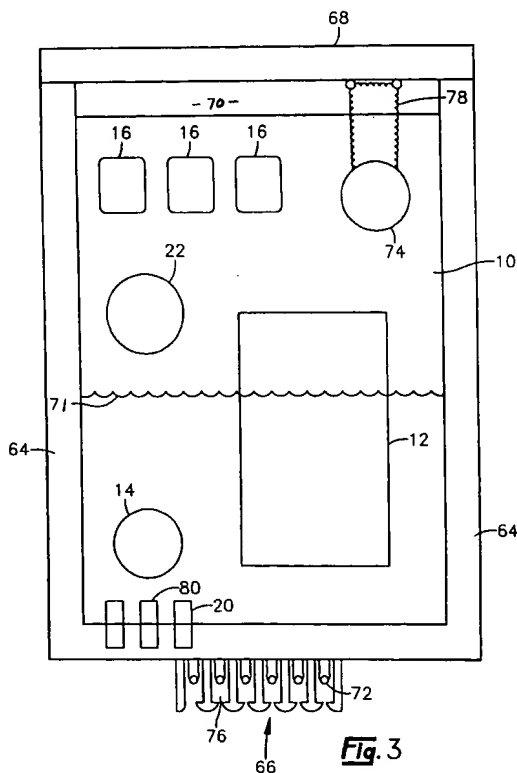
Maurelli discloses, with respect to claim 47, a communication system (See column 6, lines 58-67); a sensor and processor pairing (See figure 3, references 12, 14 and 74; column 5, 14-24);

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Aug. 8, 2000

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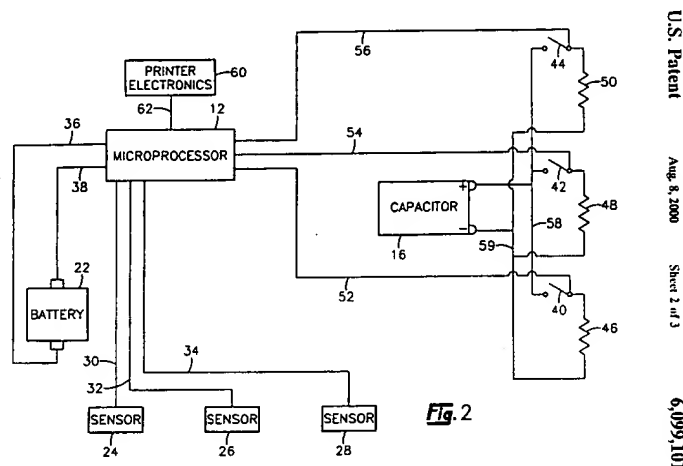
6,099,101

**Fig. 3**

a plurality of liquid containers in which sensor elements are disposed; information acquiring means for acquiring the information in the container (See figure 2, reference 12; column 6, lines 59-67); receiving means for receiving a signal from the outside (See figure 2, reference 12; column 6, lines 59-67); information communicating means for transmitting the information to the outside when a predetermined response condition is satisfied (See figure 2, reference 12;

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column 6, lines 59-67); and an outside communication means for bidirectionally communicating with the receiving means and the information communicating means of the sensor.



Maurelli discloses, with respect to claim 48, multiple inkwells and multiple sensors (See figure 2; column 6, lines 59-67). Maurelli also teaches “The conductive lines 30, 32, and 34 allow the processor 12 to periodically take a sensor 24, 26, or 28 reading and determine the status of the **respective inkwell**.” (See figure 2, references 12, 24, 26, 28, 30, 32, 34; column 7, lines 13-23). The fact that the various sensors determine the status of the respective inkwells implies that the response condition differs with each container.

Maurelli teaches, with respect to claim 50, “The printer electronics would send a polling signal to the processor 12. If the print head cartridge is not expended or expired, the processor 12 sends back a signal indicating that printing may begin. However, if the print head cartridge is expired or expended, the processor 12 will not respond to the polling signal and the printer electronics will not initiate a printing operation.” (See column 6, lines 60-67) This behavior describes the behavior of a response condition, which comprises a communication protocol. Thus, Maurelli discloses a response condition, which comprises a communication protocol.

Maurelli differs from the claimed invention in that it does not explicitly disclose a solid semiconductor element, nor does it disclose that a solid semiconductor element could replace the sensor disclosed by Maurelli in its many disclosed applications. Maurelli also does not explicitly disclose an oscillation circuit formed in a semiconductor element and provided with a conductor

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coil, nor does it explicitly disclose an outside resonance circuit disposed outside the plurality of liquid containers for generating a power with respect to the oscillation circuit of a solid semiconductor element by electromagnetic induction. Furthermore, Maurelli does not explicitly disclose that the response condition comprises an electromagnetic induction frequency.

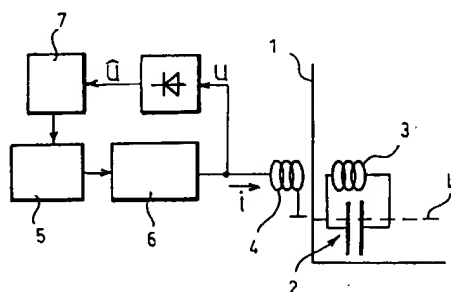
However, Maurelli does teach, with respect to claim 47, that a variety of sensors, other than the disclosed sensor, could be used (See column 5, lines 36-43). Furthermore, Moriyama (US Pat 5841448) discloses, with respect to claim 47, a conventional semiconductor sensor (See column 19, line 56).

Puukangas (US Pat 5735167) teaches, with respect to claim 47, "Within the scope of the invention, it is fully possible to use e.g. an oscillator, the frequency of the oscillator being determined by a resonance circuit in the container and so on." (See column 3, lines 48-51), and conductor coils (See figure 1, references 3 and 4; column 2, lines 16-25).

U.S. Patent

Apr. 7, 1998

5,735,167



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The oscillator disclosed by Puukangas can be configured to serve the same function as the oscillation circuit formed in the semiconductor element disclosed in the specification, and thus, can be considered an equivalent replacement. Similarly, Puukangas discloses, with respect to claim 47, a resonance circuit (See figure 1; column 3, lines 43-55), which can be considered an equivalent replacement for the pairing of the solid semiconductor and outside resonance circuit disclosed by the specification (See figures 5 and 6, references 3 and 101) because they both serve in detecting liquid level.

With respect to claim 49, Puukangas discloses a resonance frequency measured inductively (See column 2, lines 16-25). It is inherent that this induction is electromagnetic induction. Thus, Puukangas teaches that the response condition comprises an electromagnetic induction frequency.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the sensors disclosed by Maurelli with the conventional semiconductor sensors disclosed by Moriyama in order to detect liquid properties. In the invention of Maurelli, the disclosed sensor and processor (See figure 3, references 12 and 14) work together to perform the same detecting function that a single semiconductor element could perform. Therefore, the motivation for the skilled artisan in replacing the ordinary sensor disclosed by Maurelli is to gain the advantage of having a simplified detection design; instead of needing two components (sensor and processor), only one is needed (semiconductor sensor). In addition, Maurelli itself teaches that a variety of sensors (i.e. **conventional semiconductor** sensor) could replace the disclosed sensor (See column 5, lines 36-43), further confirming the obviousness of replacement.

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to incorporate the oscillation circuit with a conductor coil disclosed by Puukangas into the invention disclosed by Maurelli, as applied above. The motivation for the skilled artisan in doing so is to gain the benefit of being able to perform periodic detection. Oscillation circuits are commonly used in applications where periodic action is needed. The benefit of being able to perform periodic detection is well known to one of ordinary skill in the art.

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to incorporate the resonance circuit disclosed by Puukangas into the invention disclosed by Maurelli, as applied above. The motivation for the skilled artisan in doing so is to gain the benefit of being able to generate a power with respect to the oscillation circuit of the solid semiconductor element by electromagnetic induction. It is inherent to the oscillation circuit that it would need to have power generated in order to effectively function.

It would have been yet further obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Puukangas into the invention disclosed by Maurelli, as applied above, in order to have a response condition which comprises an electromagnetic induction frequency. The advantage of the skilled artisan in doing so is to gain the benefit of having a detection apparatus, which works with the oscillation and resonance circuit, as applied above; if the response condition did not comprise an electromagnetic induction frequency, the disclosed oscillation and resonance circuits would not work effectively.

6. Claims 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi (US Pat 5509140) in view of Maurelli (US Pat 6099101) and Moriyama (US Pat 5841448).

Koitabashi discloses, with respect to claim 53, a liquid container in which an ink to be supplied to a liquid ejection head for ejecting a liquid droplet is contained (See figures 1 and 55; column 1, lines 5-15); a first chamber which is partially connected to atmosphere and in which an absorber for absorbing a liquid is contained (See figure 15, references 3, 4, 13 and figure 55, reference 4004; column 20, lines 32-49); a second chamber which is closed from the outside and in which liquid is contained (See figure 15, references 6 and 9 and figure 55, reference 4006); a connection path, disposed in the vicinity of a bottom portion of the container, for connecting the first chamber to the second chamber (See figures 15 and 55, reference 8); a supply port which is disposed in the first chamber and via which the liquid is supplied to the liquid ejection head (See figure 15, reference 10 and figure 55); a first monitor means, disposed in the first chamber for monitoring a liquid amount of the first chamber (See figure 55, reference 4100; column 31, lines 23-53);

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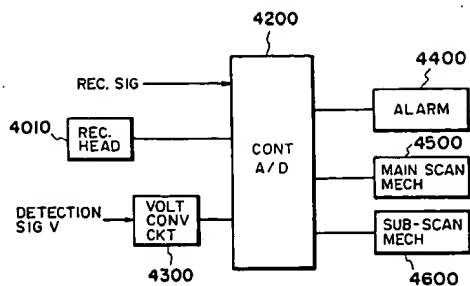


FIG. 54

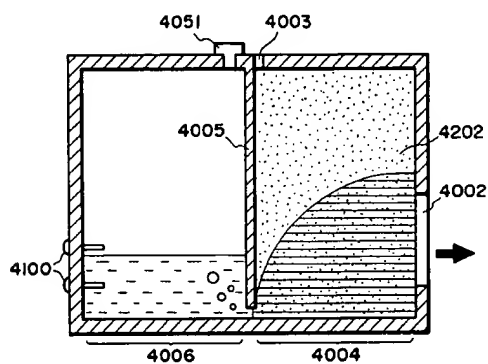


FIG. 55

and a flow rate adjustment apparatus (in the form of a absorbing material acting as a valve), disposed in the connection path for adjusting a flow rate of the connection path (See figures 19-20, references 3, A201; column 17, lines 54-67).

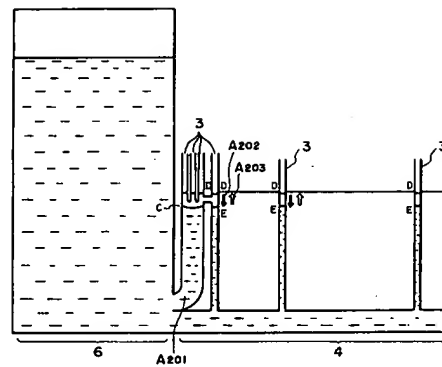


FIG. 20

U.S. Patent Apr. 16, 1996 Sheet 17 of 45 5,509,140

Koitaabashi differs from the claimed invention in that it does not explicitly disclose a second monitor means, disposed in the second chamber, for monitoring a liquid amount of the second chamber. Koitaabashi also does not disclose that the flow rate adjustment apparatus adjusts a flow rate in accordance with information from the first or second monitor means.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the first monitor means disclosed by Koitaabashi into the second chamber as a second monitor means for monitoring the liquid amount of the second chamber. The motivation for the skilled artisan in doing so is to gain the advantage of being able to measure liquid level within both the first and second chambers; measuring liquid level is useful in determining when the useful life of a ink jet print head cartridge has expired (See Maurelli column 1, lines 10-11).

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to configure the flow rate adjustment apparatus disclosed by Koitaabashi, so that it could adjust flow rate in accordance with the first and second monitor means disclosed by Maurelli, as applied above. The motivation for the skilled artisan in doing so is to gain the benefit of having a flow rate apparatus, which works in accordance with information gathered by the first and second monitor means; for example, when the liquid level in a container is low, the flow rate apparatus can adjust accordingly in order to stop ink consumption, thus allowing the ink container to be reused (See column 31, lines 54-57).

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7. Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi in view of Maurelli and Moriyama, as applied to claims 47 and 53 above, and further in view of Arai (US Pat 5179389).

Koitabashi differs from the claimed invention in that it does not explicitly disclose a solid semiconductor element, nor does it disclose that such a semiconductor element has at least pressure detection means for detecting a pressure fluctuation of the liquid. It also does not explicitly disclose an information communicating means for transmitting pressure information obtained by the pressure detection means to the flow rate adjustment apparatus, nor does it explicitly disclose an energy converting means for converting an energy applied from the outside to an energy different from the applied energy to operate the pressure detection means and the information communication means.

Maurelli, in view of Moriyama, as applied to claim 47 above, does disclose, with respect to claim 55, a solid semiconductor element used to detect liquid level. It also discloses information communicating means for transmitting liquid level information.

Arai (US Pat 5179389) discloses, with respect to claim 55, a pressure sensor, which detects pressure fluctuation of the liquid (See figure 2, reference 30; column 4, lines 39-53). Arai also discloses an energy converting means for converting an energy applied from the outside to an energy different from the applied energy (in the form of converting between pressure and electrical signals) to operate the pressure detection means and the information communicating means (See column 4, lines 39-54).

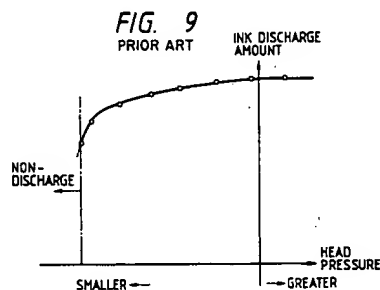
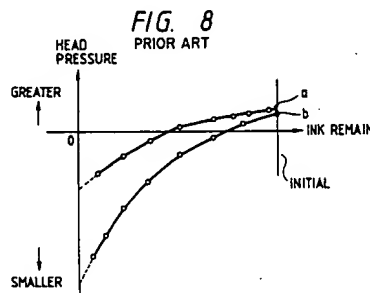
It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the solid semiconductor liquid-level detecting element disclosed by Maurelli, in view of Moriyama, as applied to claim 47 above, into the invention disclosed by Koitabashi, in view of Maurelli, in view of Moriyama, as applied above. The motivation for the skilled artisan in doing so is to gain the advantage of being able to measure liquid level within the first chamber in order to efficiently and inexpensively determine when an ink jet print head has reached the end of its useful life (See Maurelli column 2, lines 31-40).

It would have been further obvious to apply the teachings of Arai to the now-modified Koitabashi, so that the solid semiconductor element could be configured to detect pressure fluctuation as well as liquid level. The motivation for the skilled artisan in doing so is to gain the

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advantage of being able to measure the pressure fluctuation of the liquid. After all, Arai itself teaches that pressure and liquid level are correlated (See figure 8; column 2, lines 33-37). In light of this teaching, it would be obvious to have a sensor that detects both pressure and liquid level. As such, it would have also been obvious to adjust the information communicating means disclosed by Maurelli, in view of Moriyama, so that the information communicating means could also transmit pressure information obtained by the pressure detection means to the flow rate adjustment apparatus.

U.S. Patent Jan. 12, 1993 Sheet 5 of 8 5,179,389



It would have been still further obvious to incorporate the energy converting means disclosed by Arai into the invention disclosed by Koitabashi, in view of Maurelli, in view of Moriyama, as applied above in order to convert an energy applied from the outside to an energy different from the applied energy to operate the pressure detection means and the information communicating means. The motivation for the skilled artisan in doing so is to gain the benefit of being able to use the pressure detection and information communicating means disclosed above;

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it is inherent to the invention that the pressure detection and information communication means need energy in order to operate correctly.

8. Claim 56 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi, in view of Maurelli and Moriyama as applied to claims 47 and 55 above, and further in view of Ahn (US Pat 5956061).

Koitabashi, in view of Maurelli and Moriyama differs from the claimed invention in that it does not explicitly disclose that the first semiconductor element is disposed above a liquid surface of the first chamber when a liquid supply to the first chamber from the second chamber is possibly interrupted, and in a position in which a pressure fluctuation can be detected.

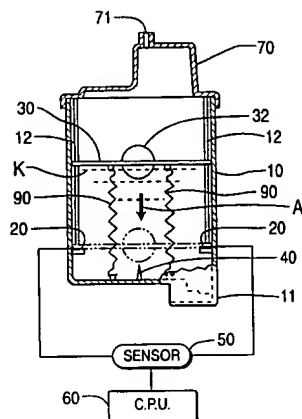
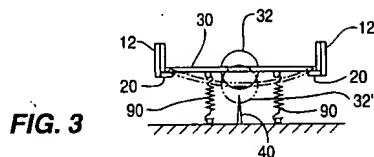
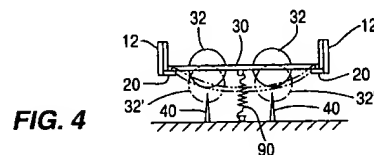
However, Ahn does disclose, with respect to claim 56, a sensing element disposed above a liquid surface (See figure 2, references 30 and 32; column 4, lines 51-65).

U.S. Patent

Sep. 21, 1999

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5,956,061

**FIG. 2****FIG. 3****FIG. 4**

Furthermore, Maurelli, in view of Moriyama teaches, with respect to claim 56, "It should be understood that a variety of sensor 14 and 74 placements and configurations could be implemented to prevent the premature disabling of the nozzle resistors 72 and the particular configuration of FIG. 3 is described for illustration purposes only." (See figure 3, references 14, 72, 74; column 2, lines 5-10) This gives motivation for configuring and positioning the semiconductor element in a variety of ways.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the teachings of Ahn and Maurelli to the invention of Koitabashi, in view of Maurelli and Moriyama, by configuring the first solid semiconductor element so that it is disposed above a liquid surface of the first chamber when a liquid supply to the first chamber

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from the second chamber is possibly interrupted. The motivation for the skilled artisan in doing so is to gain the benefit of being able to detect pressure fluctuation in this position.

9. Claim 57 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi, in view of Maurelli and Moriyama as applied to claims 47 and 55 above

Koitabashi, in view of Maurelli and Moriyama, differs from the claimed invention in that it does not explicitly disclose that the flow rate adjustment apparatus is a second semiconductor element comprising at least receiving means for receiving the pressure information from the first monitor means; an open/close valve which operates in response to the received pressure information; and energy converting means for converting an energy applied from the outside to an energy different from the applied energy to operate the receiving means and the open/close valve.

Koitabashi teaches, with respect to claim 57, "On the other hand, the liquid surface in the absorbing material rises because of the ink absorbed from the ink container, so that the liquid surface D is established, and the air-liquid exchange stops. In this state, there is no ink in the air introduction passage A201, and the absorbing material above the air introduction passage in the model, **functions simply as a valve.**" (See figure 20, reference A201)

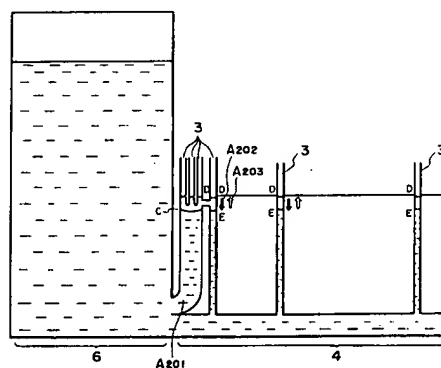


FIG. 20

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Thus, Koitabashi discloses a flow rate adjustment apparatus (in the form of a absorbing material acting as a **valve**). It will be assumed that the valve is an open/close valve

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It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the solid semiconductor element disclosed by Maurelli, in view of Moriyama as the flow rate adjustment apparatus instead of the flow rate adjustment apparatus disclosed by Koitabashi because they are equivalent structures; they can be configured to serve the same function.

In this case, in view of the receiving means disclosed by Koitabashi and Maurelli, in view of Moriyama, it would be obvious to configure the solid semiconductor element of the now-modified Koitabashi, in view of Maurelli and Moriyama, so that it comprised a receiving means for receiving the pressure information from the first monitor means. The motivation for the skilled artisan in doing so is to gain the benefit of having a flow rate apparatus, which works in accordance with pressure information gathered by the first; for example, when the pressure in a liquid container is low, the ink level is usually also low. By receiving this pressure information, the flow rate apparatus can adjust accordingly in order to stop ink consumption, thus allowing the ink container to be reused (See column 31, lines 54-57).

Finally, in view of the energy converting means disclosed by Koitabashi, in view of Maurelli and Moriyama, it would be obvious to configure the solid semiconductor element of the now-modified Koitabashi, in view of Maurelli and Moriyama, so that it comprised a energy converting means for converting an energy applied from the outside to an energy different from the applied energy to operate the receiving means and the open/close valve. The motivation for the skilled artisan in doing so is to gain the benefit of being able to operate the receiving means and open/close valve disclosed above; it is inherent to the invention that the receiving means and open/close valve need energy in order to operate correctly.

10. Claim 58 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi, in view of Maurelli, in view of Moriyama, as applied to claims 47, 53, and 55 above, and further in view of Iida (US Pat 5136309).

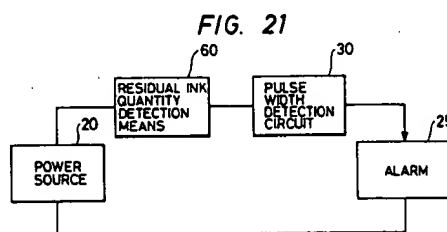
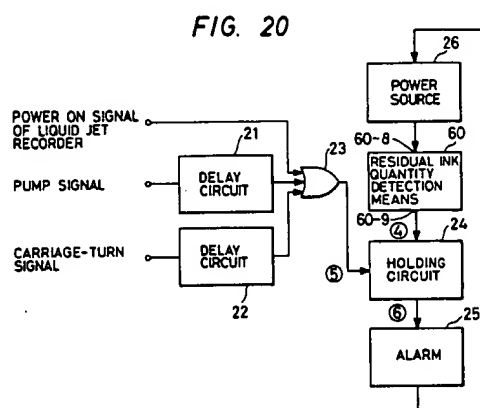
Koitabashi, in view of Maurelli and Moriyama differs from the claimed invention in that it does not explicitly disclose that the second monitor means is a third solid semiconductor element comprising: at least residual amount detection means for detecting a liquid residual amount; information communicating means for transmitting residual amount information

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obtained by the residual amount detection means to the flow rate adjustment apparatus; and energy converting means for converting an energy applied from the outside to an energy different from the applied energy to operate the residual amount detection means and the information communicating means.

Iida discloses, with respect to claim 58, a residual ink quantity detection means (See figure 21, reference 60; column 1, lines 12-35).

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In light of the teaching of Koitabashi, in view of Maurelli and Moriyama, that a first monitor means is a first semiconductor element, it would have been obvious to one having ordinary skill in the art at the time the invention was made to configure the second monitor means to be a third solid semiconductor element. The motivation for the skilled artisan in doing so is to gain the advantage of being able to measure liquid level within the second chamber; measuring liquid

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level is useful in determining when the useful life of a ink jet print head cartridge has expired (See Maurelli column 1, lines 10-11).

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to apply the teachings of Iida to the invention of Koitabashi, in view of Maurelli and Moriyama, in order to configure the solid semiconductor element so that it could detect residual amount as well as liquid level and pressure fluctuation. The motivation for the skilled artisan in doing so is to gain the advantage of being able to measure the residual amount of the liquid in order to prevent print errors due to ink shortage (See Iida column 1, lines 29-32). As such, it would have also been obvious to adjust the information communicating means disclosed by Koitabashi, in view of Maurelli, in view of Moriyama, so that the information communicating means could also transmit residual amount information obtained by the residual amount detection means to the flow rate adjustment apparatus.

It would have been still further obvious to adjust the energy converting means disclosed by Koitabashi, in view of Maurelli, in view of Moriyama in order to convert an energy applied from the outside to an energy different from the applied energy to operate the residual amount detection means and the information communicating means. The motivation for the skilled artisan in doing so is to gain the benefit of being able to use the residual amount detection and information communicating means disclosed above; it is inherent to the invention that the pressure detection and information communication means need energy in order to operate correctly.

11. Claims 59-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi, in view of Maurelli, in view of Moriyama, as applied to claims 47 and 53-59 above.

Koitabashi, in view of Maurelli, in view of Moriyama discloses, with respect to claim 60, a liquid ejection recording apparatus comprising: a liquid ejection head for ejecting a recording liquid droplet; and the liquid container according to any one of claims 53 to 59 in which the liquid to be supplied to the liquid ejection head is contained.

Koitabashi, in view of Maurelli, in view of Moriyama differs from the claimed invention in that it does not explicitly disclose that the solid semiconductor element floats on a liquid surface or in the liquid.

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However, Maurelli, in view of Moriyama, as applied to claim 47 above, discloses a solid semiconductor element, which floats in the liquid (See Maurelli figure 3, reference 14).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Maurelli, in view of Moriyama to the invention of Koitabashi, in view of Maurelli, in view of Moriyama by configuring the solid semiconductor element to float on a liquid surface or in the liquid. The motivation for the skilled artisan in doing so is to gain the advantage of being able to measure liquid level; the solid semiconductor element cannot measure liquid level unless it is touching the liquid (i.e. floating on the liquid surface or in the liquid).

12. Claim 61 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koitabashi, in view of Maurelli, in view of Moriyama, as applied to claim 60 above, and further in view of Arai (US Pat 5179389).

Koitabashi, in view of Maurelli, in view of Moriyama differs from the claimed invention in that it does not explicitly disclose that the liquid ejection head utilizes a film boiling caused when the heat energy is applied to the liquid to eject the liquid droplet via a nozzle.

However, Arai does disclose film boiling caused when the heat energy is applied to the liquid to eject the liquid droplet via a nozzle.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the teachings of Arai to the invention of Koitabashi, in view of Maurelli, in view of Moriyama so that the liquid ejection head disclosed by Koitabashi, in view of Maurelli, in view of Moriyama utilizes a film boiling caused when the heat energy is applied to the liquid to eject the liquid droplet via a nozzle. The motivation for the skilled artisan in doing so is to gain the advantage of ejecting a liquid droplet via a nozzle. This process is well known to one of ordinary skill in the art.

Allowable Subject Matter

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13. Claims 51-52 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 51 includes the limitation of a “communication system...wherein a gravity center of the solid semiconductor element floating in the liquid is positioned below a center of the element, and the floating element rocks stably without rotating in the liquid,” which was not found, taught, or suggested in the prior arts.

Claim 52 includes the limitation of a “communication system...wherein a metacenter of the solid semiconductor element is constantly positioned above the gravity center of the solid semiconductor element.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sumitomo (US Pat 4422085) discloses an ink jet viscosity control in an ink liquid supply system for an ink jet system printer.

Chocholaty (US Pat 4130126) discloses an ink maintenance sensor.

Walker (US Pat 6312074) discloses a method and apparatus for detecting fluid level in a fluid container.

Ahn (US Pat 5956061) discloses an ink supplementing device and method of ink cartridge in printing apparatus.

Kawai (US Pat 5652610) discloses an ink tank, ink tank-integrated head cartridge having the tank, and ink head constructed integrally, and ink jet printing apparatus having the ink tank or head cartridge.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonard S Liang whose telephone number is (703) 305-4754. The examiner can normally be reached on 8:30-5 Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Barlow can be reached on (703) 308-3126. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

lsl

May 10, 2002


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